

AP: CHAPTER 5A

MACROMOLECULES (Carbohydrates & Lipids)

1. Define the following:

- +1 a. Monomer The repeating units that serve as the building blocks of polymers
- +1 b. Polymer A long molecule consisting of many similar or identical building blocks linked by covalent bonds
- +1 c. Condensation reaction A chemical reaction in which 2 molecules are covalently bonded through the loss of a H_2O molecule
- +1 d. Hydrolysis A chemical rxn. in which 2 molecules are broken apart by adding a H_2O molecule. H^+ attaching to 1 and OH^- attaching to the other

+1 2. Which food (Lipids, Carbohydrates, Proteins) do you think will enter the blood the quickest? Why?

Carbohydrates \rightarrow easiest to breakdown

+1 3. What are the general roles of carbohydrates? Major fuel for living organisms and the building blocks/material for more complex molecules

+2 4. a. What carbohydrate constitutes the cell wall of plant cells? Cellulose

b. How common is this molecule? It is the most abundant organic compound

+2 5. a. How does the alpha differ from the beta form of glucose and why is it significant to animals?

Alpha glucose has the hydroxyl group below plane of ring.
Beta glucose has the hydroxyl group above plane of ring.
The beta form makes cellulose indigestible

+1 b. Explain how cows and termites can use cellulose as an energy source?

They make use of prokaryotic organisms in their gut to digest cellulose

6. Complete the following table:

Carbohydrate	Monosaccharide Composition	Biological Function
Sucrose	Glucose + Fructose	Transport Sugar in plants
Lactose	Glucose + Galactose	Milk, Energy Source
Maltose	Glucose + Glucose	Beer → Energy
Starch	Glucose ...	Energy Storage in plants
Glycogen	Glucose ...	Energy Storage in Animals
Cellulose	Glucose ...	Plant Structure
Chitin	Glucose ...	Exoskeleton in Arthropods

} Short Term

7. a. Which molecules in the first column of the table in question 8 are disaccharides?

+2 Sucrose, Lactose, Maltose

+2 b. Which are polysaccharides? Starch, Glycogen, Cellulose, Chitin

+1 8. Double sugars are called Disaccharides

List the monosaccharides that form each:

+1 a. Maltose Glucose + Glucose

+1 b. Sucrose Glucose + Fructose

+1 c. Lactose Glucose + Galactose

+1 9. Polymers of sugars form DNA, Proteins, Lipids, Carbohydrates

10. Which forms of polysaccharide is best for each function:

+1 a. Strength of structure Cellulose, Chitin

+1 b. Storage and sugar release Glycogen, Starch

+1 c. What biological theme is this addressing? Structure & Function

11. a. In what 2 forms are sugars stored in vertebrates? Glycogen and lipids

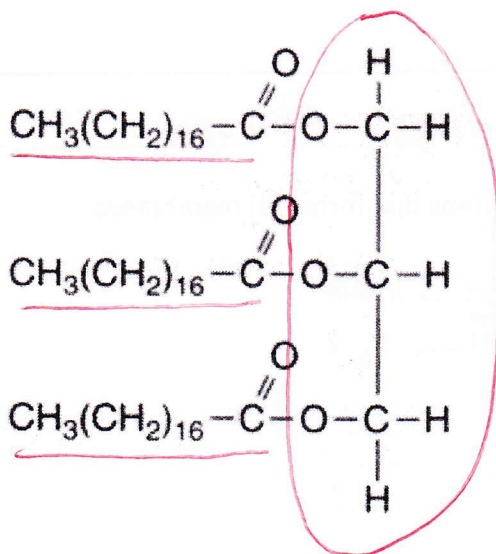
+1 b. Some plants store their food energy as oils / starch.

+1 12. What is the characteristic common to lipids? Hydrophobic

+2 13. Lipids are synthesized by the chemical reaction Dehydration / Condensation and broken down by the reaction Hydrolysis.

+1 14. What makes fats hydrophobic? Their structure → Hydrocarbon regions are nonpolar

+2 15. In the following representation of a fat, draw a circle around the portion derived from glycerol. Draw lines under the portions derived from fatty acids.

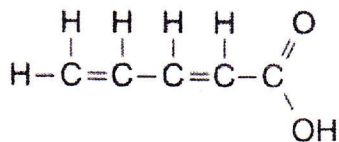


+2 16. State 2 differences between saturated and unsaturated fats.

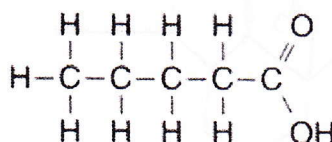
a. unsaturated has a double bond, Saturated does not

b. unsaturated liquid at room Temp, Saturated Solid

+2 17. Write the word *saturated* or *unsaturated* beneath the appropriate structure.



a. unsaturated



b. Saturated

18. Complete the following table:

lipid	Monomers	Biological function
+2 Fats and oils (triglycerides)	3 FA + Glycerol	Long Term Energy Storage
+2 Phospholipids	Glycerol + 2FA + Phosphate	Cell membrane

+2 19. a. Where are unsaturated most commonly found? Plants + Fish

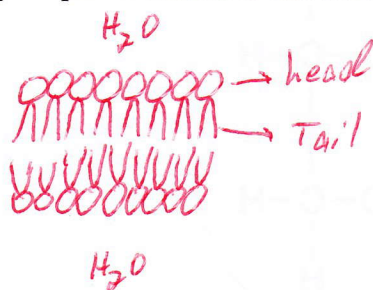
b. Name several examples of unsaturated fats. Olive oil, Cod oil

+1 20. How do phospholipids interact in an aqueous solution?

Tails Face inward away from H_2O + heads face outward towards H_2O

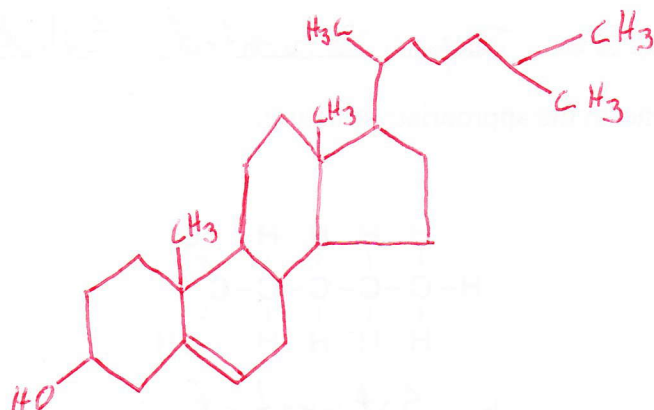
+1 21. What is the main function of fats? Energy Storage

22. Make a diagram of phospholipid interactions that form cell membranes.



+1 23. What is the common building block of steroids? Cholesterol or 4 fused rings

+2 24. Sketch the common building block of steroids.



Select the best answer.

- +½ E 25. Polymerization is a process that
- creates bonds between amino acids in the formation of a peptide chain.
 - often involves the removal of a water molecule.
 - links the sugar of one nucleotide with the phosphate of the next.
 - requires a condensation or dehydration reaction.
 - may involve all of the above.
- +½ C 26. Which of the following is *not* true of a pentose?
- It can be found in nucleic acids.
 - It can occur in a ring structure.
 - It has the formula $C_5H_{12}O_5$.
 - It has one carbonyl and four hydroxyl groups.
 - It may be an aldose or a ketose.
- +½ A 27. Disaccharides can differ from each other in all of the following ways except
- in the number of their monosaccharides.
 - as enantiomers.
 - in the monomers involved.
 - in the location of their glycosidic linkage.
 - in their structural formulas.
- +½ E 28. Which of the following is *not* true of cellulose?
- It is the most abundant organic compound on Earth.
 - It differs from starch because of the configuration of glucose and the geometry of the glycosidic linkage.
 - It may be hydrogen-bonded to neighboring cellulose molecules to form microfibrils.
 - Few organisms have enzymes that hydrolyze its glycosidic linkages.
 - Its monomers are glucose with nitrogen containing appendages.
- +½ C 29. Plants store most of their energy for later use as
- unsaturated fats.
 - saturated fats.
 - starch.
 - sucrose.
 - cellulose.
- +½ A 30. A fatty acid that has the formula $C_{16}H_{32}O_2$ is
- saturated.
 - unsaturated.
 - branched.
 - hydrophilic.
 - part of a steroid molecule.
- +½ D 31. Three molecules of the fatty acid in question 30 are joined to a molecule of glycerol ($C_3H_8O_3$). The resulting molecule has the formula
- $C_{48}H_{96}O_6$.
 - $C_{48}H_{98}O_9$.
 - $C_{51}H_{102}O_8$.
 - $C_{51}H_{98}O_6$.
 - $C_{51}H_{104}O_9$.
- +½ C 32. Cows can derive nutrients from cellulose because
- they can produce the enzymes that break the p linkages between glucose molecules.
 - they chew and rechew their cud so that cellulose fibers are finally broken down.
 - its rumen contains prokaryotes that can hydrolyze the bonds of cellulose.
 - their intestinal tract contains termites, which harbor microbes that hydrolyze cellulose.
 - they can convert cellulose to starch and then hydrolyze starch to glucose.

+½ D 33. Which of these molecules would provide the most energy (kcal/g) when eaten?

- a. glucose
- b. starch
- c. glycogen
- d. fat
- e. protein

+½ C 34. Sucrose is made from joining a glucose and a fructose molecule in a dehydration reaction. What is the molecular formula for this disaccharide?

- a. $C_6H_{12}O_6$
- b. $C_{10}H_{20}O_{10}$
- c. $C_{12}H_{22}O_{11}$
- d. $C_{12}H_{24}O_{12}$
- e. $C_{12}H_{24}O_{13}$

+½ A 35. Which of the following would be the most hydrophobic molecule?

- a. cholesterol
- b. nucleotide
- c. amino acid
- d. chitin
- e. glucose

+½ D 36. Which of the following would be the major component of the cell membrane of a fungus?

- a. cellulose
- b. chitin
- c. cholesterol
- d. phospholipids
- e. unsaturated fatty acids

+½ D 37. What are *trans* fats?

- a. hydrogenated vegetable oils that have been identified with health risks
- b. fats made from cholesterol that are components of plaques in the walls of blood vessels
- c. fats that are derived from animal sources and are associated with cardiovascular disease
- d. fats that contain *trans* double bonds and may contribute to atherosclerosis
- e. polyunsaturated fats produced by removing H from fatty acids and forming *cis* double bonds